performance advantages can be realized when compared to using a static voltage lens configuration.

Another variation with the use of multipole ion guides is the incorporation of two or more ion guides in consecutive vacuum pumping stages. This allows different $a_n$ and $q_n$ values to be set per ion guide but increases system complexity and cost. Figure 14 is a diagram of a four vacuum stage API/TOF mass spectrometer system with single vacuum pumping stage multipole ion guides 180 and 181 located in pumping stages 184 and 185 respectively. Ions in vacuum stage 183 pass through skimmer 190 and enter ion guide 180. The ions which are transported through vacuum stage 184 by ion guide 180 are focused through the aperture 194 by multipole 180 exit lens 187. The ions then enter the a second ion guide 181 in vacuum stage 185 and are focused by lens 188 through aperture 189 as they exit the multipole ion guide 181. Ions passing though aperture 189 into vacuum stage 186 are pulsed orthogonally with lens set 191 into the TOF mass analyzer 192. The multipole ion guides can be operated with independent values of $a_n$ and $q_n$ may be set to optimize the TOF duty cycle and sensitivity. Similar to the continuous multiple pumping stage multipole ion guide configuration, the dual multipole ion guide configuration as diagrammed in figure 14 can be used reduce the ion energy spread and deliver low energy ions into the mass analyzer. However, with the dual multipole ion guide configuration, losses in ion transmission efficiency may occur in the region of static voltage lenses 187 and 195 between the two multipole assemblies 180 and 181.

We claim:

1. an apparatus used for analyzing chemical species comprising:
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. two or more vacuum pumping stages with means for pumping away gas in each vacuum stage whereby each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. a mass analyzer and detector located in one or more of the vacuum pumping stages;
d. a multipole ion guide which begins in one vacuum pumping stage and extends contiguously into one or more subsequent vacuum pumping stages. Said multipole ion guide consisting of a multiple of equally spaced parallel poles extending the length of said ion guide. Said multipole ion guide is positioned in said vacuum pumping stages to guide ions delivered from said ion source through a portion of said vacuum stages;.
e. a means for applying AC and DC voltages to said poles of said multipole ion guide.
f. a means for controlling the AC frequency and said AC and DC voltages applied to said poles of said multipole ion guide;

2. An apparatus according to claim 1 where said ion source is an electrospray ion source.
3. An apparatus according to claim 1 where said ion source is an Atmospheric Pressure Chemical Ionization source.
4. An apparatus according to claim 1 where said ion source is an Inductively Coupled Plasma ion source.
5. An apparatus according to claim 1 where said multipole ion guide is a hexapole.
6. An apparatus according to claim 1 where said multipole ion guide is a quadrupole.
7. An apparatus according to claim 1 where said multipole ion guide has more than six poles.

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8. An apparatus according to claim 1 where said mass analyzer is a quadrupole mass filter.
9. An apparatus according to claim 1 where said mass analyzer is a magnetic sector mass spectrometer.
10. An apparatus according to claim 1 where said mass analyzer is a Time-Of-Flight mass spectrometer.
11. An apparatus according to claim 11 where said mass analyzer is orthogonal pulsing Time-Of-Flight mass spectrometer.
12. An apparatus according to claim 1 where said mass analyzer is a hybrid ion trap Time-of Flight mass analyzer.
13. An apparatus according to claim 1 where said mass analyzer is an ion trap mass spectrometer.
14. An apparatus according to claim 1 where said mass analyzer is a Fourier Transform mass spectrometer.
15. An apparatus according to claim 1 which includes three of said vacuum pumping stages.
16. An apparatus according to claim 1 which includes four of said vacuum pumping stages.
17. An apparatus according to claim 1 which includes more than four of said vacuum pumping stages.
18. An apparatus according to claim 1 where said ion guide extends continuously from one vacuum pumping stage into the next of said vacuum pumping stages.
19. An apparatus according to claim 15 where said multipole ion guide begins in vacuum stage one and extends contiguously from said vacuum pumping stage two.
20. An apparatus according to claim 15 where said multipole ion guide begins in vacuum stage two and extends contiguously into said vacuum pumping stage three.
21. An apparatus according to claim 1 where said ion guide extends continuously from one of said of said vacuum pumping stages through the next of said vacuum pumping stages and into the third of three consecutive vacuum pumping stages.
22. An apparatus according to claim 18 where said multipole ion guide begins in vacuum pumping stage one.
23 An apparatus according to claim 18 where said multipole ion guide begins in vacuum pumping stage two.
24. An apparatus according to claim 1 where said ion guide extends continuously from one vacuum pumping stage through more than three additional vacuum pumping stages.
25. An apparatus according to claim 1 where said means for applying AC and DC voltages to said poles of said multipole ion guide can be set to select the energy of said ions entering said mass analyzer.
26. A means according to claim 1 where said AC frequency and AC and DC voltages applied to said poles of said multipole ion guide are adjustable to maximize ion transmission efficiency through said multipole ion guide.
27. A means according to claim 1 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to maximize ion transmission efficiency through said multipole ion guide.
28. A means according to claim 1 where said means for controlling said AC frequency and AC and DC voltages applied to said poles of said multipole ion guide can be set to limit the range of mass-to-charge of said ions which can be transmitted through said multipole ion guide.

29. A means according to claim 28 where said AC frequency is fixed and said AC voltage amplitude and said DC voltages are adjusted to limit the range of mass-to-charge of ions which can be transmitted through said multipole ion guide.
30. An apparatus according to claim 1 where said background pressure in at least one of said vacuum pumping stages where said multipole ion guide is located is high enough to cause cooling of ion kinetic energy resulting in reduction of the ion energy spread for said ions of a given mass to charge transmitted through said multipole ion guide.
31. An apparatus according to claim 1 where the radial distance of the inner surface of said pole of said multipole ion guide from the centerline of said multipole ion guide is 1.5 millimeters or less.
32. An apparatus according to claim 1 where said first vacuum stage has a background pressure of less than 20 torr.
33. An apparatus according to claim 1 where said second vacuum stage has a background pressure of less than 500 millitorr.
34. An apparatus according to claim 1 where said third vacuum stage has a background pressure of less than 10 millitorr.

35. An apparatus used for analyzing chemical species comprising:
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. two or more vacuum pumping stages with means for pumping away gas in each vacuum stage whereby each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. a Time-Of-Flight mass analyzer and detector with its ion pulsing region and Time-Of-Flight tube located in one or more of said vacuum pumping stages;
d. a multipole ion guide which begins in one of the first three of said vacuum pumping stages; Said multipole ion guide consisting of a multiple of equally spaced parallel poles extending the length of said ion guide. Said multipole ion guide is positioned in said vacuum pumping stage or stages upstream of the said Time-Of-Flight mass analyzer and transmits ions which are delivered from said ion source through a portion of said vacuum stages;
e. a means for applying AC and DC voltages to the poles of said multipole ion guide;
f. a means for controlling the AC frequency and said AC and DC voltages which are applied to said poles of said multipole ion guide.
36. An apparatus according to claim 35 where said ion source is an electrospray ion source.
37. An apparatus according to claim 35 where said ion source is an Atmospheric Pressure Chemical Ionization source.
38. An apparatus according to claim 35 where said ion source is an Inductively Coupled Plasma ion source.
39. An apparatus according to claim 35 where said multipole ion guide is a hexapole.
40. An apparatus according to claim 35 where said multipole ion guide is a quadrupole.
41. An apparatus according to claim 35 where said multipole ion guide has more than six poles.
42. An apparatus according to claim 35 where said Time-Of-Flight mass analyzer includes the means for orthogonal pulsing of said ions from said pulsing region into said flight tube.
43. An apparatus according to claim 35 where said Time-Of-Flight mass analyzer includes the means for in-line pulsing of said ions from said pulsing region into said flight tube.

44. An apparatus according to claim 35 where said Time-OF-Flight mass analyzer includes an ion trap for pulsing of said ions from said pulsing region into said flight tube.
45. An apparatus according to claim 35 where said multipole ion guide which is used to guide ions through a portion of said vacuum pumping stage begins and ends in one of said vacuum pumping stages.
46. An apparatus according to claim 45 where said ions are guided through more than one vacuum pumping stage by individual multipole ion guides each of which begins and ends within its respective vacuum pumping stage.
47. A method according to claim 35 where said multipole ion guide begins in one pumping stage and extends into one or more subsequent pumping stages.
48. An apparatus according to claim 35 where said background pressure in said vacuum pumping stages where said multipole ion guide is located is high enough to cause cooling of ion kinetic energy resulting in reduction of the ion energy spread for said ions of a given mass to charge transmitted through said multipole ion guide.
49. An apparatus according to claim 35 where said means for applying AC and DC voltages to said poles of said multipole ion guide can be set to select the energy of said ions entering said Time-Of-Flight mass analyzer.
50. An apparatus according to claim 35 where said means for applying AC and DC voltages to said poles of said multipole ion guide can be set to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide.
51. An apparatus according to claim 50 where said means to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide can be set to increase the duty cycle of said Time-OF-Flight mass analyzer.
52. An apparatus according to claim 50 where said means to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide can be set to decrease the said detector dead time.
53. An apparatus according to claim 35 where the radial distance of the inner surface of said pole of said multipole ion guide from the centerline of said multipole filter is 1.5 millimeters or less.
54. An apparatus according to claim 35 where the radial distance of the inner surface of a pole of said multipole ion guide from the centerline of said multipole filter is 1 millimeter or less.

55. An apparatus used for analyzing chemical species comprising:
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. two or more vacuum pumping stages with means for pumping away gas in each vacuum stage whereby each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. an Ion Trap mass analyzer and detector located in one or more of the vacuum pumping stages;
d. a multipole ion guide which begins in one of the first three of said vacuum pumping stages; Said multipole ion guide consisting of a multiple of equally spaced parallel poles extending the length of said ion guide. Said multipole ion guide is positioned in said vacuum pumping stage or stages upstream of the said Ion Trap mass analyzer and transmits ions which are delivered from said ion source through a portion of said vacuum stages;
e. a means for applying AC and DC voltages to said poles of said multipole ion guide;

f. a means for controlling the AC frequency and said AC and DC voltages applied to said poles of said multipole ion guide;
56. An apparatus according to claim 55 where said ion source is an electrospray ion source.
57. An apparatus according to claim 55 where said ion source is an Atmospheric Pressure Chemical Ionization source.
58. An apparatus according to claim 55 where said ion source is an Inductively Coupled Plasma ion source.
59. An apparatus according to claim 55 where said multipole ion guide is a hexapole.
60. An apparatus according to claim 55 where said multipole ion guide is a quadrupole.
61. An apparatus according to claim 55 where said multipole ion guide has more than six poles.
62. An apparatus according to claim 55 where said background pressure in said vacuum pumping stages where a portion of said multipole ion guide is located is high enough to cause cooling of ion kinetic energy resulting in reduction of the ion energy spread for said ions of a given-mass to charge transmitted through said multipole ion guide.
63. An apparatus according to claim 55 where said means for applying AC and DC voltages to said poles of said multipole ion guide can be set to select the energy of said ions entering said Ion Trap mass analyzer.
64. An apparatus according to claim 55 where said means for applying AC and DC voltages to said poles of said multipole ion guide can be set to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide.
65. An apparatus according to claim 64 where said means to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide can be set to reduce the number of ions which are not in the mass to charge window of analytical interest, reducing effects due to space charging in said ion trap.

66. A method for analyzing chemical species whereby:
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. vacuum pumping is applied to two or more vacuum pumping stages such that each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. a mass analyzer and detector located in one or more of the vacuum pumping stages is used for mass analysis of said chemical species.
d. a multipole ion guide which begins within one of the first two vacuum pumping stages and extends from one vacuum pumping stage into one or more subsequent vacuum pumping stages is used to transmit ions delivered from said ion source through a portion of said vacuum stages. Said multipole ion guide consists of a multiple of equally spaced parallel poles extending the length of said ion guide.
e. The method of controlling the AC frequency and AC and DC voltages which are applied to the poles of said multipole ion guide.
67. A method according to claim 66 where said ion source used is an electrospray ion source.
68. A method according to claim 66 where said ion source used is an Atmospheric Pressure Chemical Ionization source.
69. A method according to claim 66 where said ion source used is an Inductively Coupled Plasma ion source.
70. A method according to claim 66 where said multipole ion guide utilized is a hexapole.

71. A method according to claim 66 where said multipole ion guide utilized is a quadrupole.
72. A method according to claim 66 where said multipole ion guide utilized is has more than six poles.
73. A method according to claim 66 which utilizes a quadrupole mass filter for mass analysis.
74. A method according to claim 66 which utilizes a magnetic sector mass spectrometer for mass analysis.
75. A method according to claim 66 which utilizes a Time-Of-Flight mass spectrometer for mass analysis.
76. A method according to claim 75 where orthogonal pulsing of ions is used to pulse ions in said pulsing region into said flight tube.
77. A method according to claim 75 where in-line pulsing of ions is used to pulse ions in said pulsing region into said flight tube.
78. A method according to claim 66 which utilizes an ion trap mass spectrometer for mass analysis.
79. A method according to claim 66 which utilizes a Fourier Transform Ion Cyclotron Resonance mass spectrometer for mass analysis.
80. A method according to claim 66 which includes the utilization of three of said vacuum pumping stages to remove gas entering vacuum from said ion source.
81. A method according to claim 66 which includes the utilization of four of said vacuum pumping stages to remove gas entering vacuum from said ion source.
82. A method according to claim 66 which includes the utilization of more than four of said vacuum pumping stages to remove gas entering vacuum from said ion source.
83. A method according to claim 66 where ions are transmitted through two of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously into the next of said vacuum pumping stages.
84. A method according to claim 83 where said ions enter said multipole ion guide in the second vacuum pumping stage.
85. A method according to claim 83 where said ions enter said multipole ion guide in the first vacuum pumping stage.
86. A method according to claim 66 where ions are transmitted through three of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously through the next of said vacuum pumping stages and extends contiguously into the third consecutive pumping stage.
87. A method according to claim 86 where said ions enter said multipole ion guide in the second vacuum pumping stage.
88. A method according to claim 86 where said ions enter said multipole ion guide in the first vacuum pumping stage.
89. A method according to claim 66 where ions are transmitted through more than three of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously through more than two additional vacuum pumping stages.
90. A method according to claim 66 where AC and DC voltages applied to said poles of said multipole ion guide are set to select the energy of said ions entering said mass analyzer.
91. A method according to claim 66 where said AC and DC voltages applied to said poles of said multipole ion guide are adjustable to maximize ion transmission efficiency through said multipole ion guide.

92. A method according to claim 91 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to maximize ion transmission efficiency through said multipole ion guide.
93. A method according to claim 66 where said AC and DC voltages applied to said poles of said multipole ion guide are adjustable to limit mass-to-charge range of ions which are transmitted through said multipole ion guide.
94. A method according to claim 93 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to allow a limited mass-to-charge range of ions to pass through said multipole ion guide.
95. A method according to claim 66 where said background pressure in said vacuum pumping stages where said multipole ion guide is located is maintained high enough to cause cooling of ion kinetic energy resulting in reduction of the ion energy spread for said ions of a given mass to charge transmitted through said multipole ion guide.

96. A method for analyzing chemical species whereby:
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. vacuum pumping is applied to two or more vacuum pumping stages such that each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. a Time-Of-Flight mass analyzer and detector with its primary ion beam pulsing region and Time-Of-Flight tube located in one or more of the vacuum pumping stages is used for mass analysis of said chemical species;
d. a multipole ion guide which begins in one of the first three of said vacuum pumping stages. Said multipole ion guide consisting of a multiple of equally spaced parallel poles extending the length of said ion guide. Said multipole ion guide is positioned in said vacuum pumping stage or stages upstream of the said Time-Of- Flight mass analyzer and transmits ions which are delivered from said ion source through a portion of said vacuum stages;
e. The method of controlling the AC frequency and AC and DC voltages which are applied to the poles of said multipole ion guide;
97. A method according to claim 96 where said ion source used is an electrospray ion source.
98. A method according to claim 96 where said ion source used is an Atmospheric Pressure Chemical Ionization source.
99. A method according to claim 96 where said ion source used is an Inductively Coupled Plasma ion source.
100. A method according to claim 96 where said multipole ion guide utilized is a hexapole.
101. A method according to claim 96 where said multipole ion guide utilized is a quadrupole.
102. A method according to claim 96 where said multipole ion guide utilized is has more than six poles.
103. A method according to claim 96 which includes the utilization of three of said vacuum pumping stages to remove gas entering vacuum from said ion source.
104. A method according to claim 96 which includes the utilization of four of said vacuum pumping stages to remove gas entering vacuum from said ion source.
105. A method according to claim 96 which includes the utilization of more than four of said vacuum pumping stages to remove gas entering vacuum from said ion source.

106. A method according to claim 96 where orthogonal pulsing of ions is used to pulse ions out of said pulsing region into said flight tube.
107. A method according to claim 96 where in-line pulsing of ions is used to pulse ions out of said pulsing region into said flight tube.
108. A method according to claim 96 where an ion trap is used to pulse ions out of said pulsing region into said flight tube.
109. A method according to claim 96 where said multipole ion guide which is used to guide ions through a vacuum pumping stage begins and ends in said vacuum pumping stage.
110. A method according to claim 109 where said ions are guided through more than one vacuum pumping stages by individual multipole ion guides each of which begins and ends within its respective vacuum pumping stage.
111. A method according to claim 96 where said multipole ion guide begins in one pumping stage and extends into one or more subsequent pumping stages.
112. A method according to claim 111 where ions are transmitted through two of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously into the next of said vacuum pumping stages.
113. A method according to claim 112 where said ions enter said multipole ion guide in the second vacuum pumping stage.
114. A method according to claim 112 where said ions enter said multipole ion guide in the first vacuum pumping stage.
115. A method according to claim 95 where ions are transmitted through three of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously through the next of said vacuum pumping stages and extends contiguously into the third consecutive pumping stage.
116. A method according to claim 115 where said ions enter said multipole ion guide in the second vacuum pumping stage.
117. A method according to claim 115 where said ions enter said multipole ion guide in the first vacuum pumping stage.
118. A method according to claim 95 where ions are transmitted through more than three of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously through more than two additional vacuum pumping stages.
119. A method according to claim 95 where AC and DC voltages applied to said poles of said multipole ion guide are set to select the energy of said ions entering said mass analyzer.
120. A method according to claim 95 where said AC and DC voltages applied to said poles of said multipole ion guide are adjustable to maximize ion transmission efficiency through said multipole ion guide.
121. A method according to claim 120 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to maximize ion transmission efficiency through said multipole ion guide.
122. A method according to claim 95 where said AC frequency and said AC and DC voltages applied to said poles of said multipole ion guide are adjustable to allow a limited mass-to-charge range of ions to pass through said multipole ion guide.
123. A method according to claim 122 where said method to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide can be used to increase the duty cycle of said Time-OF-Flight mass analyzer.

124. An apparatus according to claim 122 where said method to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide can be used to decrease the said detector dead time.
125. A method according to claim 122 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to allow a limited mass-to-charge range of ions to pass through said multipole ion guide.
126 A method according to claim 95 where said background pressure in said vacuum pumping stages where said multipole ion guide is located is maintained high enough to cause cooling of ion kinetic energy resulting in reduction of the ion energy spread for said ions of a given mass to charge transmitted through said multipole ion guide.
127. A method according to claim 150 for transmitting said ions to said mass analyzer with a small cross section ion beam diameter by transmitting said ions through said multipole ion guide of small size where the innermost surface of said pole of said multipole ion guide from the centerline of said multipole in guide is 2.5 millimeters or less.

128. A method for analyzing chemical species whereby;
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. vacuum pumping is applied to one or more vacuum pumping stages such that each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. an ion trap mass analyzer and detector is used for mass analysis of said chemical species;
d. a multipole ion guide which begins in one of the first three of said vacuum pumping stages. Said multipole ion guide consisting of a multiple of equally spaced parallel poles extending the length of said ion guide. Said multipole ion guide is positioned in said vacuum pumping stage or stages upstream of the said ion trap mass analyzer and transmits ions which are delivered from said ion source through a portion of said vacuum stages.
e. The method of controlling the AC frequency and AC and DC voltages which are applied to the poles of said multipole ion guide.
129. A method according to claim 128 where said ion source used is an electrospray ion source.
130. A method according to claim 128 where said ion source used is an Atmospheric Pressure Chemical Ionization source.
131. A method according to claim 128 where said ion source used is an Inductively Coupled Plasma ion source.
132. A method according to claim 128 where said multipole ion guide utilized is a hexapole.
133. A method according to claim 128 where said multipole ion guide utilized is a quadrupole.
134. A method according to claim 128 where said multipole ion guide utilized is has more than six poles.
135. A method according to claim 128 which includes the utilization of three of said vacuum pumping stages to remove gas entering vacuum from said ion source.
136. A method according to claim 128 which includes the utilization of four of said vacuum pumping stages to remove gas entering vacuum from said ion source.
137. A method according to claim 128 where ions are transmitted into the ion trap through an endplate aperture.
138. A method according to claim 128 where ions are transmitted into the ion trap through a gap between the trap electrodes.

139. A method according to claim 128 where said multipole ion guide which is used to guide ions through a vacuum pumping stage begins and ends in said vacuum pumping stage.
140. A method according to claim 139 where said ions are guided through more than one vacuum pumping stages by individual multipole ion guides each of which begins and ends within its respective vacuum pumping stage.
141. A method according to claim 128 where said multipole ion guide begins in one pumping stage and extends into one or more subsequent pumping stages.
142. A method according to claim 141 where ions are transmitted through two of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously into the next of said vacuum pumping stages.
143. A method according to claim 142 where said ions enter said multipole ion guide in the second vacuum pumping stage.
144 A method according to claim 142 where said ions enter said multipole ion guide in the first vacuum pumping stage.
145. A method according to claim 128 where ions are transmitted through three of said vacuum pumping stages using said ion guide which begins in one of said vacuum pumping stages and extends contiguously through the next of said vacuum pumping stages and extends contiguously into the third consecutive pumping stage.
146. A method according to claim 145 where said ions enter said multipole ion guide in the second vacuum pumping stage.
147. A method according to claim 145 where said ions enter said multipole ion guide in the first vacuum pumping stage.
148. A method according to claim 128 where AC and DC voltages applied to said poles of said multipole ion guide are set to select the energy of said ions entering said ion trap mass spectrometer.
149. A method according to claim 128 where said AC and DC voltages applied to said poles of said multipole ion guide are adjustable to maximize ion transmission efficiency through said multipole ion guide.
150. A method according to claim 149 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to maximize ion transmission efficiency through said multipole ion guide.
151. A method according to claim 128 where said AC frequency and said AC and DC voltages applied to said poles of said multipole ion guide are adjustable to allow a limited mass-to-charge range of ions to pass through said multipole ion guide.
152. A method according to claim 151 where said method to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide can be used to decrease the effects due to space charging in the ion trap mass spectrometer.
153. A method according to claim 151 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide limiting the mass-to-charge range of ions passing through said multipole ion guide.
154. A method according to claim 128 where said AC frequency and AC and DC voltages are adjusted to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide to reduce the number of ions which are not in the mass to charge window of analytical interest and reducing effects due to space charging in said ion trap.

155. A method according to claim 128 where said background pressure in said vacuum pumping stages where said multipole ion guide is located is maintained high enough to cause cooling of ion kinetic energy resulting in reduction of the ion energy spread for said ions of a given mass to charge transmitted through said multipole ion guide.

156. An apparatus used for analyzing chemical species comprising:
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. two or more vacuum pumping stages with means for pumping away gas in each vacuum stage whereby each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. an Fourier Transform Ion Cyclotron Resonance (FT-ICR) mass analyzer and detector located in one or more of the vacuum pumping stages;
d. a multipole ion guide which begins in one of the first three of said vacuum pumping stages; Said multipole ion guide consisting of a multiple of equally spaced parallel poles extending the length of said ion guide. Said multipole ion guide is positioned in said vacuum pumping stage or stages upstream of the said FT-ICR mass analyzer and transmits ions which are delivered from said ion source through a portion of said vacuum stages;
e. a means for applying AC and DC voltages to said poles of said multipole ion guide;
f. a means for controlling the AC frequency and said AC and DC voltages applied to said poles of said multipole ion guide;
157. A method according to claim 160 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to maximize ion transmission efficiency through said multipole ion guide.
158. An apparatus according to claim 156 where said means for applying AC and DC voltages to said poles of said multipole ion guide can be set to select the energy of said ions entering said FT-ICR mass analyzer.
159. An apparatus according to claim 156 where said means for applying AC and DC voltages to said poles of said multipole ion guide can be set to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide.

160. A method for analyzing chemical species whereby:
a. an ion source operated at or near atmospheric pressure which produces ions from solution and delivers said ions into a first vacuum pumping stage through an orifice;
b. vacuum pumping is applied to one or more vacuum pumping stages such that each successive vacuum pumping stage has a lower background pressure than the previous pumping stage;
c. an FT-ICR mass analyzer and detector is used for mass analysis of said chemical species;
d. a multipole ion guide which begins in one of the first three of said vacuum pumping stages. Said multipole ion guide consisting of a multiple of equally spaced parallel poles extending the length of said ion guide. Said multipole ion guide is positioned in said vacuum pumping stage or stages upstream of the said FT-ICR mass analyzer and transmits ions which are delivered from said ion source through a portion of said vacuum stages.
e. The method of controlling the AC frequency and AC and DC voltages which are applied to the poles of said multipole ion guide.

161. A method according to claim 160 where said AC frequency is fixed said AC voltage amplitude is adjusted and said DC voltages are adjusted to said poles of said multipole ion guide to maximize ion transmission efficiency through said multipole ion guide.
162. A method according to claim 160 where said AC frequency and said AC and DC voltages applied to said poles of said multipole ion guide are adjustable to allow a limited mass-to-charge range of ions to pass through said multipole ion guide.
163. A method according to claim 160 where said method to reduce the range of mass to charge of said ions which are transmitted through said multipole ion guide can be used to decrease the effects due to space charging in the FT-ICR mass spectrometer.

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